

Fodor vs. Darwin: A Methodological Follow-Up

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In a series of publications, which appeared in the last 3 years¹ Jerry Fodor launched an attack at what many believe is the core of Darwinian theory of evolution – the theory of natural selection. Fodor complains that the theory of natural selection “can’t explain the distribution of phenotypic traits in biological populations” (Fodor, 2008, p.11) and his main argument, slightly simplified², is the following: In order to play its explanatory role properly, the theory of natural selection must rely on “nomologically necessary generalizations about the mechanisms of adaptation as such” (Fodor, 2008, p.23). There are not good candidates for such “nomologically necessary generalizations”, therefore, the theory of natural selection cannot explain what it is supposed to explain.

Not surprisingly, Fodor’s attack provoked a strong, mostly negative, reaction³. Fodor’s critics have complained that he does not really understand how evolutionary biology works⁴. They have

¹ See (Fodor, 2007a), (Fodor, 2007b), (Fodor, 2008a), (Fodor & Piatelli-Palmarini, 2010).

² The original form of Fodor’s “putative argument” is the following:

“(i) Explaining the distribution of a phenotypic trait in a population would require a notion of ‘selection for’ a trait. ‘Selects for ...’ (unlike ‘selects...’) is opaque to substitution of co-referring expressions at the ‘...’ position.

(ii) If T1 and T2 are coextensive traits, the distinction between selection for T1 and selection for T2 depends on counterfactuals about which of them *would be* selected in a *possible* world where the *actual* coextension doesn’t hold.

(iii) The truth makers for such counterfactuals must be either (a) the intensions of the agent that affects the selection, or (b) laws about the relative fitness of having the traits.

(iv) But:

Not (a) because there is no agent of natural selection.

Not (b) because considerations of contextual sensitivity make it unlikely that there are laws of relative fitness (‘laws of selection’).

(v) QED.” (Fodor, 2008, p.11)

³ See (Sober, 2008), (Godfrey-Smith, 2008), (Dennett, 2008), (Block & Kitcher, 2010), (Ruse, 2010).

⁴ Block and Kitcher (2010), for example, say that Fodor’s argument is “biologically irrelevant”, Dennett (2008) blames Fodor for relying too much on a “caricature of scientific practice”, and Ruse (2010) states explicitly that what one can only say about Fodor’s claims concerning the theory of natural selection is “that this is a misunderstanding of the nature of science”.

insisted both that his main argument is unsound and that his central claim is false. I can generally agree with the first part of their criticism: Fodor's 'putative argument' does rely on controversial premises which make it unsound⁵. However, I don't think that Fodor's critics have succeeded in their attempts to refute his central claim. The refutation strategy that most of them have undertaken is to show examples of successful evolutionary explanations by natural selection. In what follows I analyze two of these examples, which have been suggested by the philosophers of biology Elliott Sober and Peter Godfrey-Smith. The analysis reveals that:

- (1) In both examples the evolutionary explanations by natural selection rely on additional empirical hypotheses; these hypotheses might be true but they also might be false. This observation is in tune with what Fodor has said about the successful evolutionary explanations: they are such because evolutionary biologists have at their disposal more than the theory of natural selection. Thus the theory of natural selection should be only partially credited with the explanatory success of such explanations.
- (2) In both cases alternative non-evolutionary explanations can be found that fit the same empirical data and no reason has been given why these alternative explanations should be ignored a priori as inferior.

The observations (1) and (2) stand against the claim that theory of natural selection is the only legitimate explanance for the distribution of phenotypic traits. This does not mean, of course, that natural selection does not play any explanatory role or that the theory of natural selection is a false theory (as Fodor is inclined to argue for). This only means that there is indeed a problem of understanding the proper explanatory role of natural selection and that this problem is not only Fodor's problem. In the conclusions of this paper an outline will be given of what should be admitted in order to get to a better understanding of the explanatory role of the theory of natural selection.

The first example: Fisher's sex ratio model

According to Sober (2008), what Fisher mathematically inferred on the basis of his model is a good candidate for a law, which explains/predicts the 1:1 sex ratio which is observed in most species: "If producing equal numbers of sons and daughters and producing more daughters than sons are the alternative reproductive strategies that a parent might follow in a randomly mating population, and if the cost of rearing a son is the same as the cost of rearing a daughter, then there will be selection for following the first strategy and against following the second" (Sober, 2008, p.45).

Fisher's argument (see Fisher, 1939) is going in the following direction. If we assume for a while that the males in a given population are less in number than the females, the average contribution

⁵ I, for example, agree that "nomologically necessary generalizations" are not necessary conditions for producing good explanations.

of each male to the total reproductive value (the offspring) of this population will be, for obvious reasons, higher than the average female contribution to the same reproductive value. That means that the parents who possess the natural tendency to produce more sons than daughters will create a higher contribution to the total reproductive value of the population. Thus their genes will spread more than the genes of those who are not genetically disposed to have more sons than daughter and this tendency will last until the moment when the contribution to the reproductive value of males and females become equal and this will happen when they become equal in number.

Fisher's principle has often been celebrated as one of the most remarkable achievements of evolutionary biology (Edwards, 1998). This is so not only because it successfully explains the observed 1:1 sex ratio in most species but also because it implies the empirically confirmed prediction that if in a given population rearing sons is more 'expensive' than rearing daughters, there will be 'selection for' producing smaller number of sons than daughters⁶.

Despite the broadly admitted explanatory success of Fisher's principle, two things about its use must be stressed.

First, Fisher's principle only works as supporting selectionist explanations of sex ratio if we assume that there is a genetically inherited disposition to produce more male or more female births. This is an empirical conjecture which has not been yet confirmed for most species. (For sure, at the time when Fisher published his book there had not been any evidence for the existence of such inheritable dispositions). That means that the evolutionary explanations of sex ratio based on Fisher's principle are in the best tentative explanations.

Second, those who seem to neglect the tentative character of Fisherian sex ratio explanations have probably never asked seriously the question is it possible to explain what Fisher's principle explains without assuming the influence of any selection pressure? Because if they had asked this question they would easily discover that the answer is 'yes' for both the 1:1 ratio prediction when daughter and sons cost equally and the prediction that less sons will be given birth if rearing a son is twice as expensive as rearing a daughter. The ratio 1:1 can be easily explained by just assuming that sex allocation is a random process. Then in the case of two sexes, the prediction is exactly about equal number of male and female births. Let's suppose that for certain reasons (a dreadful war, or a strange men-killing pandemic disease) the number of men is crucially reduced. The ratio 1:1 will be restored immediately in the next generation just because of the randomness of the process of sex allocation. What about the asymmetry between male and female births when rearing a son is most costly? It also allows a simple explanation by just assuming equally probable male and female births and assuming also that all female parents can make (and do make) a limited investment in rearing children.

⁶ This prediction has been well confirmed by some recent studies of sexually dimorphic Hymenoptera (Seger & Stubblefeld, 2002).

Let me clarify this by the following example. Let's assume that rearing a boy is twice more costly than rearing a girl and that the maximal investment which each mother can make is for four daughters (or two sons). Then in a situation of a random sex allocation we have the following 8 possible cases: (The strings below represent the possible sequences of births, 'S' stands for giving birth to a son, and 'D' stands for giving birth to a daughter⁷:

- (1) S S
- (2) S D S
- (3) S D D
- (4) D S S
- (5) D S D
- (6) D D S
- (7) D D D S
- (8) D D D D

If all 8 cases are equally probable, in a population obeying the stated above conditions there will be 10x male births vs. 15x female births. Thus there will be a strong bias (2:3) toward less male than female births and this will happen independently of any selection pressure. Notice, that no assumption about inheritable dispositions to have more sons than daughters or vice versa is needed in this explanation.

It is well known that what is broadly called 'Fisher's principle' is not Fisher's invention. The roots of the underlying argument can be traced back to Darwin's first edition of *Descent of Man* (1871), where he presented a similar, although more obscure, line of reasoning. For many, it is still a curious fact, however, that Darwin dropped his sex ratio evolutionary explanation from the second (quite more broadly known) edition of the book, providing the following explanation, which one can find also cited by Fisher (1930): "In no case so far as we can see, would an inherited tendency to produce both sexes in equal numbers or to produce one sex in excess, be a direct advantage or disadvantage to certain individuals more than to others; ... I formerly thought that when a tendency to produce the two sexes in equal numbers was advantageous to the species, it would follow from natural selection, but I now see that the whole problem is so intricate that it is safer to leave its solution for the future" (Darwin, 1874, p.399)

⁷ It is seen that in cases (2), (4), and (7) the investment exceeds the limit. This happens because before the last birth the mother still has resources for one more daughter but instead of a daughter she gives a birth to a son. Excluding the last births of these cases, however, will not change the general result.

There are different explanations of Darwin's decision to abandon what has been later recognized by the mainstream evolutionary biologist as 'the right explanation'. But in the light of the presented above alternative non-selectionist explanations of the chief sex ratio phenomena, Darwin's cautiousness does not look that strange or stupid.

I am far from the idea to call for a radical revision of current models of sex ratio dynamics. I do admit that these models are a great success of modern biology insofar the existence of many important correlations which have been predicted by these models (for example, correlations between parental investment, sex rates, and mating schemas) have been also empirically confirmed⁸. But it is a well known fact that correlation does not imply causal connection. In the case of the sex ratio models, the correlations do not imply any causal "selection for" particular observed sex ratios. On the contrary, what I hopefully have been able to demonstrate, many of those empirically confirmed correlations allow non-selectionist explanations.

Let me summarize what the Fisher's principle example reveals about the explanatory role of theory of natural selection. Two important observations are to be stressed. First, the principle plays its explanatory role only in conjunction with the empirical conjecture that there might be inheritable dispositions for having more sons than daughters or vice versa. Second, the phenomena, which this principle explains allow alternative non-selectionist explanations. This means that further research is needed in order to decide whether the evolutionary explanations describe the actual course of events better than their non-evolutionary rivals. Before having the results of this research, one cannot conclude that natural selection is a necessary part of any proper explanation of the distribution of all observable phenotypes.

The second example: the evolutionary explanation of aging

Godfrey-Smith's (2008) discussion on the evolutionary explanations of aging has been provoked by Fodor's complain that these explanations are essentially post-hoc: "it's often suggested that the reason there are so many diseases of old age is that creatures can't compete for representation in the gene pool once they become infertile. But then, why didn't selection just increase the length of the fertile period?" (Fodor, 2008, p.13)

In reply, Godfrey-Smith presents two of the most influential models of the evolution of aging, which, he notes, are not incompatible. Both models aim to describe how the evolution brings to the phenomena of aging in a population which at the start did not show any senescence.

According to the mutation accumulation theory (Medawar, 1952), aging is a by-product of natural selection which has successfully 'selected against' detrimental mutations that manifest their effects in early age (the individual possessing such mutation either die before achieving reproductive age, or do not reproduce because of different malfunctions) but has failed to 'select against' any harmful mutations which effects are switched on at later age. Mutation

⁸ For a recent review of research in this field see (Hardy, 2002).

accumulation theory has produced several testable hypotheses which have been confirmed. For example, it predicted successfully that inbreeding depression should increase with age (Hughes et al., 2002). However, this theory does not produce correct predictions for populations which are free of predators (Bowles, 2000). So, the assumption that there have been enough natural accidents to reduce the number of the older individuals in the initial showing no senescence population is vital for the explanatory success of mutation accumulation theory.

The antagonistic pleiotropy theory of aging (Williams, 1957) seems to remedy the defects of Medawar's model but only on the cost of a new assumption that some genes may effect more than one trait in an organism (pleiotropy) and that these connected traits may play antagonistic roles with respect to fitness. According to this theory, aging appear because evolution has 'selected for' traits which are advantageous to reproductive success earlier in life but which are genetically connected to traits which become harmful at later age. The theory predicts that genes that increase the early age productivity will in the same time lead to speeding-up the process of aging. The evidence for this hypothesis, however, is controversial (see Economos & Lints, 1986).

As in the case of Fisher's sex ratio principle, the evolutionary explanations of aging also have their non-evolutionary rivals – to mention only the programmed aging theory, neuroendocrine theory, wear-and-tear theory, immune system theory et. c. – see (Pankow & Solotoroff, 2007) for a review. Some of these theories demonstrate no less explanatory success than the evolutionary theories, according to (Bell, 1984) and (Le Bourgh, 1998)⁹.

So, given that the explanations of aging by natural selection rely on additional hypotheses which have not been yet well confirmed, and given that rival non-evolutionary explanations have the same explanatory success, are there any reasons to claim that the theory of natural selection is the only legitimate explanance for aging? The answer of this question, I think, is obvious.

Conclusions

The analysis of two examples of evolutionary explanations by natural selection reveals that these explanations are in the best tentative hypotheses, which are not directly inferred from the theory of natural selection but rely in an essential way on additional empirical conjectures which are to be tested independently. In this sense Fodor's claim that theory of natural selection cannot, on its own, explain the distribution of phenotypic traits is correct. It seems to be correct also because there are alternative non-evolutionary explanations for the distributions at least of some phenotypic traits and these alternative explanations cannot be simply ignored as inferior. The practice of ignoring the non-evolutionary alternatives without paying attention to how plausible are they and what is their explanatory power is typical for Darwinian fundamentalism. But

⁹ But it should be noticed in the same time that the evolutionary biologist also complain that their theories have been almost completely ignored by the representatives of the mainstream gerontology (see Rose et al. 2008).

Darwinian fundamentalism which might be indeed harmful for science must be distinguished from Darwinism. Darwin himself was quite cautious to warn that natural selection is just one of the many forces in the process of evolution.

Darwinian fundamentalism builds on a deep misunderstanding of the proper explanatory role of the theory of natural selection. That's why getting to a better understanding of how the theory of natural selection contributes to the evolutionary explanations is vital for the successful overcoming of harmful selectionist fundamentalism. Perhaps a lot of work is to be done in this direction but it may suffice as a beginning to take seriously the following. Natural selection is a negative force. That means that literally it only 'selects against'. 'Selection for' is a metaphor for what has survived the 'selection against'. But the explanation that a particular phenotypic trait is there because it has not been selected against is at best a partial explanation. It misses the essential complementary story about what made this trait to flourish and this story must necessarily rely on additional hypotheses that in themselves might have nothing to do with selection. However, the success of the evolutionary explanations 'by natural selection' depends crucially on the truth of such additional hypotheses. I am completely aware that what I just have said is not news but the reaction against Fodor's attack on what he has (wrongly) recognized as 'Darwinism' has convinced me that it deserves to be stated again.

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